STANDARD ELEVATOR
(Hecker Elevator)
(Nesbitt Elevator)
(Pillsbury Elevator)
1 St. Clair Street
Buffalo
Erie County
New York

HAER No. NY-241

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA
REDUCED COPIES OF MEASURED DRAWINGS
PHOTOGRAPHS

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

STANDARD ELEVATOR
(Hecker Elevator)
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(Pillsbury Elevator)
HAER No. NY-241

Location:	1 St. Clair St., Buffalo, Erie County, New York
Date:	Mainhouse: Building permit issued January 17, 1928; completed October, 1928 Annex: Building permit application July 30, 1941; approved August 13, 1941
Designer:	Mainhouse: A. E. Baxter Engineering Co. Annex: I.H. Faleide, McKenzie Hague & Co.
Builder:	Mainhouse: James Stewart Co. Annex: McKenzie Hague & Co., Chicago.
Status:	Operational
Significance:	The grain elevators of Buffalo comprise the most outstanding collection of extant grain elevators in the United States, and collectively represent the variety of construction materials, building forms, and technological innovations that revolutionized the handling of grain in this country.
Project Information:	The documentation of Buffalo's grain elevators was prepared by the Historic American Engineering Record (HAER), National Park Service, in 1990 and 1991. The project was co-sponsored by the Industrial Heritage Committee, Inc., of Buffalo, Lorraine Pierro, President, with the cooperation of The Pillsbury Company, Mark Norton, Plant Manager, Walter Dutka, Senior Mechanical Engineer, and with the valuable assistance of Henry Baxter, Henry Wollenberg, and Jerry Malloy. The HAER documentation was prepared under the supervision of Robert Kapsch, Chief, HABS/HAER, and Eric DeLony, Chief and Principal Architect, HAER. The project was managed by Robbyn Jackson, Architect, HAER, and the team consisted of: Craig Strong, Supervising Architect; Todd Croteau, Christopher Payne, Patricia Reese, architects; Thomas Leary, Supervising Historian; John Healey, and Elizabeth Sholes, historians. Large-format photography was done by Jet Lowe, HAER photographer.

Historians: Thomas E. Leary, John R. Healey, Elizabeth C. Sholes, 1990-1991

This is one in a series of HAER reports for the Buffalo Grain Elevator Project. HAER No. NY-239, "Buffalo Grain Elevators," contains an overview history of the elevators. The following elevators have separate reports:

NY-240 Great Northern Elevator
NY-241 Standard Elevator
NY-242 Wollenberg Grain & Seed Elevator
NY-243 Concrete-Central Elevator
NY-244 Washburn Crosby Elevator
NY-245 Connecting Terminal Elevator
NY-246 Spencer Kellogg Elevator
NY-247 Cooperative Grange League Federation
NY-248 Electric Elevator
NY-249 American Elevator
NY-250 Perot Elevator
NY-251 Lake & Rail Elevator
NY-252 Marine "A" Elevator
NY-253 Superior Elevator
NY-254 Saskatchewan Cooperative Elevator
NY-256 Urban Elevator
NY-257 H-O Oats Elevator
NY-258 Kreiner Malting Elevator
NY-259 Meyer Malting Elevator
NY-260 Eastern States Elevator

In addition, the Appendix of HAER No. NY-239 contains brief notations on the following elevators:

Buffalo Cereal Elevator
Cloverleaf Milling Co. Elevator
Dakota Elevator
Dellwood Elevator
Great Eastern Elevator
Iron Elevator
John Kam Malting Elevator
Monarch Elevator
Pratt Foods Elevator
Ralston Purina Elevator
Riverside Malting Elevator

The Standard Elevator stands next to the Buffalo River, immediately upstream of the Ohio Street Bridge and was built in two phases of development dating from 1928 and 1941. Through its subsidiary the Hecker Company, the Standard Company had Buffalo connections from an earlier date. The Hecker Company established a milling operation in 1913 in the newly completed Keystone Warehouse complex, designed by the A. E. Baxter Company of Buffalo. The mill incorporated a small elevating and storage facility. In the 1920s the Standard Company planned a massive mill and elevating complex to be built on newly reclaimed land on the Buffalo lake shore. This design was also by the A. E. Baxter Company and, if completed, would have been the largest milling complex in the world. The elevator alone was to have a storage capacity of seven million bushels. The scheme was abandoned before construction commenced, however, and the Hecker-Jones-Jewell subsidiary was responsible for the expansion of Standard-owned facilities in Buffalo.

Having acquired the Buffalo River site in 1926, the company planned an ambitious expansion scheme, intending to consolidate its existing Buffalo and New York City operations on the new site. The first phase, an elevator and mill, was to be followed by a doubling of the storage capacity and two additional mills. The total storage capacity was to be 5 million bushels and the mill was to have a daily output of 25,000 barrels. Only the first elevator was actually built, however. A change of policy led to a scaling down of the plans, and the equipment from the New York City operation was transferred to the existing facility.

The new elevator appears to have been considered surplus to requirements, and within a year of its commission the new Hecker Elevator, as it was originally known, was sold to the Eastern Grain Company. The new owners renamed it the Nisbet Elevator and used it to supplement the existing water to rail transfer facilities at the Concrete-Central complex. The Standard Company re-acquired the elevator in 1938, re-named it the Standard Elevator, and in 1940 revived the original plans to build both a mill and an annex to the elevator on the site. Once again the plans were not carried through to completion, and only the storage annex was finished.

For the entire operating history of the Hecker/Standard concerns in Buffalo, milling facilities remained in the Keystone complex. The elevator provided storage for the inland facility at the Keystone site and a forwarding facility for contract grain. With the closure of Standard's milling facilities in the town during the 1980s, the elevator became surplus to that company's requirements and the Pillsbury Company acquired the site to replace its Great Northern facility. Although generally known as the Standard Elevator, the facility was officially known as the Pillsbury Elevator in 1990.[1]

The Standard Mainhouse lies alongside the river and occupies the westernmost part of the site. The first stage of the milling complex was built parallel to the elevator, while the second elevator of similar design and capacity extended eastward along the river. The elevator measures 532' x 78'-4" and features workhouses at both ends. The western workhouse was intended to supply grain to the onsite mill, while the eastern was designed to provide a transfer facility for contract grain. Both structures were the work of the Buffalo-based A. E. Baxter Engineering Company.

The elevator design was based on the principles established in Budd's 1921 patent, and represents a prototype by the Baxter Company that was followed and developed in all their subsequent elevator commissions in Buffalo. Examples include the Eastern States "A" Elevator of 1934, the GLF "C" Elevator of 1936, the GLF "A" Elevator of 1941 and the Eastern States "B" Elevator of 1946. The Baxter design features bin bottoms that are raised within the bin walls and bear on an annular concrete ring girder supported by radially arranged basement pillars. However, unlike the Budd-designed Superior "C" of 1925 where the ring girder has a circular inner face, the Baxter design is characterized by an inner face with a dodecohedral geometry of twelve flat inner faces.

The elevator was built during the 1928 construction season. The site preparation works were undertaken in late 1927, and the building permit was issued on January 17, 1928. The elevator was completed and received its first shipment of grain in October of 1928. The James Stewart Company of Chicago raised the elevator in two lifts of 10 x 3 bins, for a total of sixty bins. Upon completion, the structure provided the largest single unit of storage in Buffalo, and the building remains the largest single unit of conventional bin storage built as a single project in the history of Buffalo elevator construction. Its capacity was only exceeded by the storage hall design of the Cargill Electric. Both bins and workhouses were slip formed from the foundation slab using Folwell Sinks patent jacks. The estimated cost of the elevator was $450,000, or 15 cents per bushel of capacity. These figures demonstrate that the theoretical economies of the Budd design were being achieved in practice by the late 1920s.

The elevator has a capacity of three million bushels stored in sixty main bins, three of which are horizontally sub-divided, and thirty-eight interspace bins. The elevator is without outerspace bins but does include six square washer and drier bins. The bin walls rise from the foundation slab to a height of

124', but the depth of the bins is less than the total wall height.

The main bins are arranged in three parallel non-interlocking rows of twenty bins. The bins have a 25' interior diameter and are arranged in tangential contact on 26' centers. The contact thickening extends for 4'-4" on either side of the center line. The top of the ring girder is located 12' above the base of the bin wall and the bins extend upwards at full width from this point for 112'. The bin hopper bottoms rest within, and extend below, the annular concrete ring girder to give a total bin depth of 119'. The three westernmost main bins are horizontally sub-divided; that on the riverside is divided into a shallow upper shipping bin with a lower storage bin. The remaining two bins provide a workhouse function and accommodate a cleaner floor at half height. The two 46' deep upper bins provide feed facilities to the cleaners and clippers, while the two lower bins, in addition to receiving from the cleaners and clippers, also receive washed and dried grain from the adjoining drier house.

The interspace bins are of conventional form and are arranged in two rows of nineteen bins. The bin walls are 8" thick, except within the tangential thickening where the minimum figure is 12". The lowest 14' of bin wall is constructed of 3/4:1:2 concrete; between 14' and 21' the mixture is 1:1-1/2:3, and above this point it is proportioned in a 1:2:4 mix.

The vertical reinforcing is composed of twelve round verticals and twelve jacking rods placed alternately about the circumference of the bins. The jacking rods are positioned at the four points of tangential contact with two additional rods placed in the wall between these points. This configuration provides rods spaced equidistantly about the bin wall on 7' centers. The configuration is slightly modified in the exterior bin walls, where one jacking rod is dispensed to give a 9' spacing between rods. An ordinary vertical between every jacking rod gives a spacing between the vertical reinforcing elements of 3'-6" in the interior walls and 4'-6" in the exterior walls. At a time when engineers were introducing designs that rationalized the number of verticals employed in interior walls, these arrangements were unusual. The verticals are placed on the center line of the walls, and the horizontals are wired to the outside of the verticals in the typical fashion.

The horizontal reinforcing is composed of 204 tank bands of graduated rods at varying course intervals. In the lowest 10' of walling which forms the basement walls are nine courses of round rod at 12" intervals. From the base of the ring girder to a height of 90', 160 courses of round rod are at 6" intervals.

Between 90' and 110', the course interval increases to 12". From 110' to the bin floor, the bands are placed in 12" courses.

The arrangement of horizontals within the divided cleaner bins is somewhat different. The same arrangement of rods placed at 12" course intervals applies to the basement bin walls below the ring girder. The lower bin is reinforced with 106 courses of rod on 6" centers over its entire depth of 53'. The cleaner floor is 63' above the floor slab and extends to a height of 16'. Here the wall reinforcement is analogous to that of the basement walling--fifteen bands of rod on 12" centers. The base of the upper bins lies at a height of 79' above the foundation slab. The upper bins are reinforced as separate bins, the first 11' with thirteen bands of rod on 10" intervals. Between 11' and 31', the upper bins are reinforced with nineteen bands of rod on 12" centers. The upper 15' of the bin wall is reinforced with rods on 12" centers. The base of these upper bins is supported on concrete beams measuring 4' x 1'-8" and 2'-6" x 1'-4". The beams span the width of the bins.

The bins are capped by a 4" thick reinforced concrete bin slab incorporated monolithically with the bin walls. The bin slab extends beyond the bin line to form a prominent overhanging eave and rests on steel I-beams, the ends of which protrude beyond the bin line and have a concrete cover to produce a corbel detail. The hoppering for the main bins is provided by a conical steel hopper extending the full width of the bin. The hopper rests within an annular concrete ring girder which is raised within the bin and supported by six radially arranged basement pillars. The hoppering is angled at 35°. The ring girder is 4'-6" deep and 2'-6" at its widest point. The girder abuts the bin wall but is structurally separate from it.

The inner side of the girder has twelve flat faces, effectively producing a ring girder composed of twelve "beams." A basement pillar is placed centrally below alternate "beams." The ring girder "beams" supported by a basement pillar are reinforced with seven non-trussed 3/4" rods in their upper parts and two non-trussed 1/2" rods in their lower part. The beams unsupported by a basement pillar are reinforced for stress reversals with five non-trussed upper rods 3/4" in diameter, and two non-trussed lower rods 1/2" in diameter. Each beam has ten 1/2" hoops linking the main reinforcing elements. The six basement pillars measure 2' x 1'-4" and are 8'-6" in height. They are placed at 45° intervals about the circumference of the bin.

The interspace bins have reinforced concrete slab hopper bottoms that rest on a square of concrete beams spanning the interspace and are supported within the main bin walls. These walls extend through the basement to the floor slab. They are pierced by 8' wide longitudinally positioned conveyor passages within the area of tangential contact thickening. Diagonally placed personnel passages also pierce the bin walls. The total height of the basement is 8'-6", one-third of which lies below grade level.

The elevator is built on 4'-6" diameter concrete caissons that extend 9' to rock. The caissons are distributed so as to coincide with the extremities of the tangentially thickened bin wall; each bin is supported by eight caissons, each of which is shared by adjoining bins. The caissons support a network of foundation beams measuring 6'-2 in depth and between 5' and 3'-6" in width. Although this network of beams forms octagons below every main bin, these are incomplete, as the beams do not continue below the transverse tangential bin contacts. The beams, sufficiently wide to fully support the basement pillars, are reinforced with upper and lower systems of straight rods. The foundation beams support a 10" thick floor slab reinforced with a diagonal grid of 1/2" round rods on 15" centers.

The bin floor is spanned by a single-story gallery that extends to a width of 34'-2". The gallery is of reinforced concrete pillar, beam and slab construction. The pillars are placed above the tangential bin contacts. The roof slab extends beyond the wall line to form an overhanging eave, while the roof beams similarly extend to form a corbel detail complimenting that of the bin floor below. The gallery is lit and ventilated by deep windows arranged in a pattern of alternate long and short windows.

Workhouses of reinforced concrete and slip formed construction at both ends of the building extend to a height of 192'. Both rise from ground level but only reach their full dimensions above the bin gallery. The eastern workhouse is 38' x 36' and extends for 29' over the bins. The western workhouse is 38' x 21' and also extends for 29' over the bin floor. Above the bin floor, both workhouses have three stories--a distribution floor, a scale floor and a head floor. The eastern house accommodates a single concrete garner bin and the western house two concrete garner bins. The garners are incorporated monolithically into the structure, and are supported on 4'-1" deep concrete beams. The garners measure 18' x 16'-8" and are 27'-4" deep. Each discharges through nine draw-off spouts.

The workhouse walls are of slip formed pier and panel construction. The reinforcing consists of inner and outer sets of horizontal and vertical reinforcing with jacking rods arranged independently in the center of the walls. The piers and panels are 12" and 8" thick respectively. The piers coincide with the division of the rectangular scale garner bins and serve to strengthen the fillet at the intersection of bin walls. Transverse trussed concrete beams support, in ascending order, the distribution floor, scale floor and hoppers, the garner bin bottoms, and the machinery floor. The spacing and dimensioning of the beams vary, but the largest are those required to support the garner bottoms and the elevating machinery. Jacking rods are located centrally within the wall on 5'-9" centers but are independent of the main reinforcing. The main reinforcing within any wall is made up of inner and outer verticals and horizontals. The inner and outer verticals are offset and vary in number, being most frequent (every 15") in the wall of the garner bin.

The horizontal rods are graduated and coursed at varying intervals. The dimensions and coursing of inner and outer rods vary independently. The horizontal coursing is at its most dense (every 3") at the base of the garner bin, graduating upwards to resume the average 12" coursing towards the top of the bin. The graduation of verticals in the workhouse garner bins contrasts with the simpler non-graduated arrangement in the typical non-cylindrical workhouse storage bins, as in GLF "A" for example. In the latter, the storage bins are of relatively small cross sectional area, and have a single central draw-off spout. The workhouse garner bins, although much shallower, have a larger cross sectional area, and draw-off takes place through nine spouts. The frequent and rapid draw-off of grain through multiple spouts during weighing operations can produce surge pressures that are transmitted to the garner bin walls. Additional steel is required to allow for this condition.

A double-track corrugated iron car loading shed was provided below the eastern workhouse. The elevator was equipped with two movable marine towers of structural steel and corrugated iron. A drier and washer house is located immediately to the west of the western workhouse.

The building permit for this structure was issued in August of 1928, and its design and construction were in the hands of the companies responsible for the main elevator. Although physically separate, it was operationally an integral part of the mainhouse. The building, of slip formed reinforced concrete construction, features a false gable detail and parapet. It is 27' x 32' and extends to a height of 115'-9'. The drier and washer house contain seven 12' long, 66'-3" deep rectangular bins, five of which are arranged along the eastern side of the building. The central bin is 8'-4" wide, while the remainder are 6'-2" in width. The washing plant was originally installed below these bins. The western side of the building contains two shallow bins measuring 19' x 13' and placed at the corners of the structure with the driers and coolers located below. The space between these bins is occupied by stairs, elevating legs and a personnel elevator. A single-story transformer house, constructed under a separate building permit issued in May of 1928, is located along the western boundary of the site.

The re-acquisition of the elevator by the Standard Company in 1938 brought about a revival of the original scheme for the site. The company commissioned the construction of an annex to the elevator in 1941. Although contemporary plans show that it intended to construct a mill adjoining the original elevator with provision for a second mill beside the annex, no milling capacity was installed on the site. The building permit for the Standard Elevator Annex was approved in August of 1941, and the bins were raised by November of the same year. Construction involved the consolidation of the riverbank and the construction of a new dock line. However, as the marine tower tracks did not extend alongside the annex, all grain had to be received and shipped through the mainhouse.

The building measures 357'-11-1/2" x 78'-4" and was built and probably designed by "construction and design engineers" at the McKenzie Hague Company of Chicago. The only example of the company's work in Buffalo, it illustrates many interesting and innovative features. The elevator is of the bin wall basement design with bin hopper bottoms raised on radially arranged basement pillars. By devising a means of spreading the main bins longitudinally without disrupting basement conveyor paths, the McKenzie Hague Company was able to produce Buffalo's only example of a bin wall basement design featuring conventional outerspace bins.

Of all the Buffalo elevators, the Standard Annex makes the greatest use of concrete in various elements, as in its unique reinforced concrete conical bin bottom hoppers. Concrete was probably substituted for steel in some applications as a means of conserving steel stocks during wartime. The elevator also boasts the largest concrete bins ever built in Buffalo. The main bins' capacity of 102,400 bushels is more than four times that of the main bins at Concrete-Central. Although a relatively complex structure, the Annex was constructed with great economy, and demonstrates this aspect of the bin wall basement design. The estimated cost of construction was $275,000, providing storage at 13 cents per bushel of capacity.

The Standard Annex has a capacity of 2,000,000 bushels stored in sixteen main bins, seven interspace bins and fourteen outerspace bins. The main bins are arranged in two non-interlocking parallel rows of eight. The bins are in tangential contact transversely but are spread longitudinally on 45'-6" centers. The area of tangential wall thickening extends for 7'-

6" on either side of the center line. At 15' wide, this bin wall thickening is the most extensive of any conventionally binned Buffalo elevator, and reflects the stress differences that can occur between bins of such volume when adjoining bins are subject to differing loading conditions. The bins are connected by straight longitudinal link walls inside the center line of the bin row, both to increase outerspace volume and to provide a basement conveyor passageway below the center line of the bins. If conventional link walls were used, then that part of the link wall extending into the basement would interrupt a conveying system positioned to receive grain from centrally placed draw-off spouts.

A supplementary straight "strut wall" spans the outerspace longitudinally and is placed toward the outside of the bin center line. The strut wall is analogous to a link wall, except that it is divided vertically into three 15' sections. Both link and strut walls are 7'-2-1/2" in length.

All bins are 38'-1-1/2" in inner diameter except towards the eastern end of the building, where the bin line tapers to accommodate the curve of the railroad tracks serving the elevator. The final bin of the southern (riverside) row is 36' in diameter, while the last two bins of the northern (inland) row are 30' in diameter. The bin walls extend 124'-6" from the foundation slab to the bin floor. However, as the bin bottoms are raised within the cylinders, the actual depth of the bins is less. Measured from the draw-off spout to the bin floor, the main bins are 116'-3" deep and extend above the ring girder at full width for 105'-6". The three smaller main bins are slightly shallower, as the ring girder is raised a further 1'-6" within the bin walls. The 38' bins have a capacity of 102,000 bushels, the 36' bins can contain 91,000 bushels and the 30' bins hold 62,000 bushels.

The single row of interspace bins of conventional form occupies all seven interstices between adjoining cylindrical bins. Measured from the draw-off spout to the bin floor, these bins are 117' deep and have a capacity of 40,000 bushels. Of the fourteen outerspace bins, six are along the northern (inland) elevation, and seven along the southern (riverside) elevation. These bins have conventional convex exterior walls built to the same radius as the main bins and extend beyond the bin center line to the inwardly placed link walls. An additional outerspace is located along the western end wall of the elevator. This bin has a straight exterior link wall and is of small capacity as it terminates against the transverse tangential wall thickening. Measured from the draw-off spout, the outerspaces are 117' deep, and, with the exception of the bin mentioned above, have a capacity of 22,000 bushels. The capacity of the outerspaces of this elevator equal that of the main bins of the Wait-designed elevators such as Concrete-Central and Superior "A" and "B". Outerspace bins are absent in the two available spaces along the diagonal northeast end wall.

The bin, link and strut walls are all 8" thick. The minimum thickness of the bin wall in the tangential contact is also 8". The proportioning of the concrete in the bin walls is not known. The vertical reinforcing in the exterior bin walls is a combination of jacking rods and ordinary verticals, while in the interior bin walls it is made up exclusively of jacking rods. Both ordinary verticals and jacking rods are of 1/2" round rod. Eighteen jacking rods are placed about the circumference of the main 38'-2-1/2" bins. Two are on 8'-9" centers in that part of the bin forming an exterior wall. The remaining fifteen rods are on 6'-6" centers within the interior part of the main bin wall. Jacking rods are absent in link and strut walls. To ensure adequate pull on the forms in this area, the bin wall jacking rods to either side of the point of intersection with link and strut walls are arranged at a reduced interval of 4'.

Conversely, in the area of tangential contact thickening, the interval between jacking rods increases to 8'-9". A jacking rod is at the point of tangential contact, and the next rods are just beyond the area of wall thickening. Ordinary verticals between the jacking rods of the exterior walls provide a 2' interval between the vertical elements of the reinforcing system. Three such verticals were required between the jacking rods of the outerspace quarter walls and that part of the main bin walling forming an exterior wall. The ordinary verticals are 13'-10" long. Successive rods were lapped over a distance of 1'-8" and wired together. The jacking rods are 15'-5" in length and were spliced together with sleeves in the usual manner. The verticals were placed within the center of the bin walls and the horizontal reinforcing wired to the outside of the verticals.

The horizontal reinforcing, possibly the most complex system employed in a Buffalo elevator, is 191 tank bands of round rod of graduated diameter at varying course intervals. The horizonal steel in both link walls and quarter walls is graduated; the coursing intervals in the main bin walls alter by as little as 1/2" to produce a finely engineered structure with an optimum use of materials. The lowest part of the wall below the ring girder forms the basement wall and is not subject to high tensile stresses. It is reinforced with thirteen bands of rod in 12" courses. From the base of the ring girder at 14'-6" upward, the walls are reinforced with rod at course intervals increasing with height. Above 99' a constant coursing interval of 10" is retained but the rod sizes diminish with height. The horizontal reinforcing for the outerspace quarter walling has the same course intervals as the main bin bands. Unusually, the rods within the quarter walling are also graduated by height.

An increase in quarter wall rod size between 64'-6" and 99' is required, as the optimum coursing interval has been determined for the main bin walling. From 99' to the bin floor, 1/2" rod is on 10" centers. Link and strut walls have double link rods at course intervals corresponding to the main tank bands, over which they are hooked. Single contact anchors are placed at the extremities of the tangentially thickened main bin walls, where they hook about the jacking rods located close to this point. The contact anchors hook about the jacking rods in the usual manner. Triple contact anchors are employed at the intersection of the quarter wall and main bin walls. Such a strong arrangement is unique to the Annex and reflects the stresses involved in bins of such large capacity. Two of the contact anchors pass through the fillet between the quarter walls and main bin walls. Rather than passing through the fillet, the third contact anchor ties the quarter bin forward, linking the exterior segment of the main bin to the quarter walling.

The main bins discharge centrally through a conical reinforced concrete hopper bottom angled at 40°. The Standard Annex provides the only example of such construction in Buffalo. The hopper bottom is supported by an annular concrete ring girder with which it is structurally integrated to form a monolithic whole. The ring girder is 4'-6-1/2" deep, 5'-10" wide and has a curved inner face. The ring girder is raised 14'-6" within the bin cylinder and is supported by freestanding radially arranged basement pillars measuring 1'-10" x 1'-6". Eight such pillars are at 45° intervals within the 38'-2" bins, while only six pillars are necessary in the smaller bins. The concrete hopper bottoms are 6" thick and reinforced by a system of radial and circumferential rods. Radial rods in the lower part of the hopper are at 4° intervals. In the upper part of the cone unsupported by the ring girder, the radial rods are placed at 2° intervals. The circumferential rods are 1/2" in diameter and located towards the base of the hopper concrete. They are on 12" centers near the apex of the hopper, and on 6" centers in the upper part of the cone unsupported by the ring girder.

The circumferential rods in the uppermost part of the hopper form part of the reinforcing system of the ring girder. In the lower part of this area, they consist of rods placed on 6" centers, and in the upper part of this area of a double row of five, 1-1/4" rods also at 6" intervals. The base of the ring girder is reinforced by ten 1/2" circumferential rods tied together with 1/2" square bar hoops at 10" intervals.

The hoppering within the interspace bins consists of two concrete hopper slabs that slope away from the center of the bin to discharge through spouts at either side of the bin close to the link walls. By this means, the interspace may be discharged to either basement conveyor. The slab is supported by a central longitudinal beam that bridges adjacent main bin tangential wall thickenings and is supported at its center by a single basement pillar. The outerspace bins have concrete hopper slabs sloping to a discharge spout located close to the link wall. This slab is supported by a section of the strut wall within the basement and by a longitudinal beam spanning the outerspace between the contact fillets.

The main bin walls extend through the basement and are pierced between the link walls and strut walls by longitudinal conveyor passages. Personnel passages are arranged diagonally so that people may pass between the area below the main bins. The basement height is 14'-6" to the ring girder. Half the basement lies below grade level, and illumination is provided by two small upper windows per bin cylinder.

The elevator is built on rectangular reinforced concrete sub-piers that extend to rock. Piers are located below all tangential contacts, where they measure 10'-6" x 4', below both link and strut walls, where they measure 8' x 4', and below main bin/quarter wall contacts, where they are 6'-4" x 3'. The upper part of the piers steps outward to form a broad head. By this arrangement, all radial basement pillars bear directly on the foundation works. The head of the tangential contact piers measures 19'-6" x 9'-6", that of the link and strut wall piers 15' x 6'-9", and the quarter wall contact piers, 12' x 5'-6". With the exception of a single transverse foundation beam spanning the interspace between the link wall sub-piers and longitudinal foundation beams linking the quarter wall sub-piers, individual piers form no part of the network of foundation beams. The sub-piers support a 9" thick overall floor slab.
The bins are capped by a monolithic reinforced concrete bin floor covered across two-thirds of its width by a single-story reinforced concrete gallery.

With the completion of the Annex, there has been little subsequent development at the site. A railroad car tipper was added to the north of the original car shed in 1955. The steel and corrugated iron building features a 79' tall elevator tower. The railroad loading shed added below the western workhouse was probably built during Eastern Grain's tenure, when the western workhouse was converted to serve a transfer function.

BUSINESS HISTORY

Buffalo's third largest grain elevator opened on October 14, 1928, when the SS J.B. John delivered 75,000 bushels of wheat and 40,000 bushels of corn to the $2.5 million facility. Located at 1 St. Clair Street on the Buffalo River, the new elevator was owned by the Hecker-Jones-Jewell Milling Company of New York City, a subsidiary of the Standard Milling Company of New Jersey. Both companies have a long history in Buffalo, before their merger and after, and the St. Clair Street Elevator has operated under both names.

Hecker was the more familiar name to Buffalo in 1928. The company already operated two small elevators and milling sites. The Hecker H-O Company leased the property at 54 Fulton to manufacture the popular H-O Hot Oatmeal, Force Flakes, and Presto Self-Raising Flour.[2] Hecker's larger mill was located at 503 Seneca Street. This 4,400 cwt. mill was leased from Keystone Warehouse Company in 1912 but run under the Hecker-Jones-Jewell imprimatur until the late 1930s when Standard Milling assumed control.[3]

In May, 1920, Hecker announced plans to double not only its own milling capacity but that of Buffalo. The company purchased seventeen acres on the outer harbor from the Buffalo Creek, Lehigh Valley, and Erie Railroads with an eye to constructing two elevators, each with a 3 million-bushel capacity. In addition the company planned to add a 25,000-bushel-a-day mill to manufacture flour, cereal, and livestock feed. That plan was slightly modified in 1923 but remained grandiose in design. Neither conception was ever enacted, as outer harbor plans were jettisoned in favor of the more realistic St. Clair Street proposal.[4]

The plans for the 1928 elevator were developed in 1926 by Hecker's parent company, Standard Milling. Through its Hecker subsidiary, Standard bought 8-1/2 acres from Buffalo Freight Terminal & Warehouse. Plans were then filed for the new elevator, but Standard still cherished the intention of adding a flour mill with a 10,000-barrel-per-day capacity.[5] By the time the elevator was fully constructed, however, the company had revised its plans again, allowing the elevator to operate as a private terminal facility serving its two existing mills.

At least part of the reason for the inconsistencies in planning stemmed from conditions in the agricultural economy of the 1920s. The early part of the decade was bolstered by recovery and expansion after World War I. Grain dealers and millers received increased supplies of grain, and improved wheat prices made expanded foreign and domestic trade possible and increased profits more likely. Buffalo's grain receipts increased rapidly between 1918 and 1919, declined somewhat in 1920, and rebounded almost 30 percent in 1921 and 18.2 percent in

1922. A decline in 1923 was followed by peak years--a yield of over 200 million bushels between 1924 and 1928. The difficult agricultural years for farmers did not dampen either the volume of Buffalo's trade or the interest of speculators in price and market control. In 1928 Buffalo received its largest shipments ever (279,666,342 bushels), which, ironically, coincided with both the beginning of the worst phase of agricultural depression and the best speculative returns for grain traders and merchants.[6]

The nature of the company's organization also shaped Standard's erratic decisions concerning what and where to build. Both Hecker-Jones-Jewell and Standard Milling emerged from the frenzied period of trust formation characterizing the 1890s. Hecker was the result of a merger of five milling companies that consolidated in 1892 in New York City and later incorporated in New Jersey. Led by Thomas A. McIntyre, the five companies were George V. Hecker & Co., Jones & Co., Jewell Milling Co., Staten Island Milling Co., and King County Mills. In 1907 the company incorporated in New York to consolidate its business and operating functions. Three years later, Hecker-Jones-Jewell closed its original mills (including the 1842 Hecker) and opened one large 20,000-cwt. mill in New York City.[7]

In the interim, however, Hecker-Jones-Jewell had gained and lost its independence, all in less than a decade. Hecker's success spurred McIntyre to greater heights; in 1899 he created a gigantic trust he dubbed United States Flour Milling Company which combined milling operations in several states including Hecker-Jones-Jewell.[8] Less than one year later, however, in February, 1900, the trust's petition for reorganization threatened paybacks to bond holders. As United States Flour Milling trembled on the brink of receivership, it was beset by lawsuits from bond holders like Mrs. Ora M. Jewell, who moved to break the trust agreement that eroded her and other creditors' equity. Mrs. Jewell's suit was dismissed, but the trust collapsed nonetheless.[9]

From the ashes of the flour trust debacle, financial receivers created Standard Milling Company as a new holding company for the trust's most lucrative properties, including Hecker-Jones-Jewell. Standard was run by those financiers strictly as a holding company, leaving operations to the wholly-owned subsidiaries such as Hecker. Meanwhile, Standard became the conduit for property acquisitions and sales.[10] The Company's first foray into Buffalo came shortly after its creation. When Urban emerged from the United States Flour Milling Trust as an independent entity and established a new mill on Urban and Kehr streets, Standard purchased the original Urban Milling property at 324 Oak. The new company's presence in Buffalo was shortlived, however, as it left the city after 1905.[11]

In 1912 Standard's subsidiary, Hecker-Jones-Jewell arrived in Buffalo to establish the Seneca Street Flour Mill. In 1925 it acquired Edward Ellsworth's H-O Oats Company and the company and elevator on Fulton were renamed Hecker H-O.[12] During the 1920s, Hecker-Jones-Jewell Mills functioned in Buffalo without its own grain elevator for support. Nevertheless, the company flourished with its popular consumer flours and cereals and merchant flour products destined for sale to the baking industry. The success of the Buffalo operations certainly encouraged the New York headquarters and the parent corporation to direct substantial capital into the city. The top priority was development of a grain elevator.

The parent corporation, however, was under some financial pressure. From 1926 to 1928, its debts were comparatively large relative to assets, and its stock values vacillated considerably through the whole of the decade. The company was unquestionably prosperous but scarcely capable of assuming the projected $10-13 million necessary to finance the outer harbor plan. In 1926 the company already had debts equal to 80 percent of assets; an additional $11 million would have nearly doubled the debt and made payback impossible. The $2.5 million cost for the St. Clair Street Elevator was far more realistic.[13]

In early 1928 Standard's comparative fiscal conservatism paid off. The company had vastly improved its profitability without increasing its commensurate debt. Existing and projected milling and storage properties, coupled with the boom in grain traffic, gave the company prospective profit margins that would fuel Standard's continued healthy growth.[14] These improvements made Standard a tempting takeover target, and in April, 1928, it was rumored that Standard would merge with Washburn-Crosby, the forerunner of General Mills.[15] Later that same year, the company authorized a stock-issue bonus to officers and employees as a reward for a job well done.[16]

Such evidence of prosperity brought Standard to the attention of a newly-created investment company, the Gold Dust Corporation. Gold Dust was incorporated in September, 1928, to consolidate a number of previously independent companies. One of these was American Linseed; New York City's largest flaxseed and linseed oil operation, it had functioned on the Buffalo River since the 1880s. To build Gold Dust, the investors bought out the Rockefeller family's preferred stock control over American Linseed, sold its edible oils to Buffalo's Spencer Kellogg, and prepared to employ the capital generated in the sale for acquisition.[17]

In December of 1928, Gold Dust purchased 40,000 shares of Standard Milling stock which Standard sold to generate its own capital and retire part of its funded debt. Less than one month later, in January, 1929, Gold Dust announced its intent to takeover Standard Milling.[18] The takeover was by no means completely friendly. Standard Vice President Frederick L. Rodewald actively opposed the proposed stock swap with Gold Dust and in February petitioned every stockholder to withhold approval for the merger. It was too late. The very next day, February 7, the requisite 51 percent of stock was placed in escrow prefatory to the completion of the merger.[19] Gold Dust's acquisition of Standard gave the speculator company control of all subsidiaries and properties including those in Buffalo--the Hecker Mill, the Hecker H-O Oats Plant, and, of course, the brand-new elevator.

The Gold Dust takeover of Standard came at an inauspicious time. The harvest bounty of 1928 was not repeated in 1929, and grain receipts in Buffalo fell by over 40 percent. The problems were compounded by the stock market crash of October that squeezed even profitable operations. Gold Dust continued to make money but at a declining rate. The company had to absorb losses incurred by Standard's sale of capital assets just prior to the takeover, and by 1930, Gold Dust was forced to liquidate Standard Milling of Canada.[20] To compensate for the declines in assets and profits, Gold Dust also moved to divest itself of properties with a high cash value but less necessary use. One of these was the new grain elevator in Buffalo.

In June, 1929, less than four months after Gold Dust acquired the Standard and Hecker properties, the St. Clair Street Elevator was sold to a local Buffalo investor and grain merchant, Nisbet Grammer, president of Eastern Grain Elevator Corporation. Grammer owned the new elevator but ran it, along with four others, on behalf of Eastern.[21] For the next ten years, the elevator would be known as the Nisbet.

Gold Dust retained control of the existing Hecker Milling operations in Buffalo. In May, 1930, another move to consolidate assets worked to Buffalo's advantage, when Gold Dust elected to close the Hecker-Jones-Jewell Mill in New York City and transfer all the machinery to Buffalo; the Seneca Street Mill's capacity was increased to over 5,000 bushels per day.[22] Continuing decline in Depression-era grain receipts, however, eroded demand for elevator capacity in Buffalo and other ports. By 1937 Buffalo received only 85 million bushels, compared to the nearly 290 million nine years earlier. The lack of business hurt all United States elevators and mills, but the less diversified local owners, such as Eastern, were damaged most severely. Eastern Grain was also in a state of flux from internal problems of leadership after the death of its two founders, Grammer in 1935 and John J. Rammacher in 1938. With all of the external and internal pressures, Nisbet Elevator was closed in 1937 and sold once again in 1939.[23]

The irony behind the 1939 sale was that it was a repurchase of the St. Clair Street Elevator by none other than Gold Dust, renamed Hecker Products Corporation in a 1936 reorganization. The purchase was effected through Standard Milling, which had been made a subsidiary of Hecker. As a result of that ownership arrangement, the elevator obtained its more familiar name, the Standard. Eastern Grain Elevator sold the elevator to Standard for a mere $500,000, considerably below its construction cost and presumably below its unpublished 1929 sale price.[24] The deflated cost was interpreted as a reflection of generally declining real estate values on Buffalo's waterfront; it certainly reflected a considerable windfall for Standard and a blow to Eastern Grain.

From 1936 to 1946 Hecker Products operated with fewer autonomous divisions, several of which had been subsumed under Standard Milling, now an operating company rather than just a holding company. In Buffalo this meant that the St. Clair Street Elevator and Seneca Street Mill were part of Standard, while the Hecker H-O Cereal Elevator and mill were separate and operating under Hecker Products alone.[25] In 1946 Standard Milling spun off entirely from Hecker (renamed Best Foods) and relocated to Kansas City, Missouri, as a completely independent company. The Standard Elevator and Standard Milling were part of the new company without ties to Hecker. Standard continued to operate the elevator until 1981, when it was sold to Pillsbury, the Minneapolis-based company operating on Buffalo's City Ship Canal. Pillsbury continues to operate the Standard as a private terminal elevator.[26]

MATERIALS HANDLING: HISTORY AND DESCRIPTION

Among the remaining active grain elevators on Buffalo's waterfront, the Standard is the nearest living descendant of the classic nineteenth-century wooden marine transfer and storage structures inspired by Joseph Dart and Robert Dunbar. Unlike Frontier, American or Lake & Rail, the Standard is visually unencumbered by adjacent grain processing facilities. As the storage house for Pillsbury/Archer-Daniels-Mildland's Ganson St. operations, the elevator still retains its historic functions of receiving deliveries by water or rail combined with intermodal transshipment, in this case chiefly loading out to trucks.

Receiving by Water

Grain delivered in lake vessels was unloaded by a pair of movable marine towers capable of traversing a dock situated between the elevator and the north (right) bank of the Buffalo River. Each tower's marine leg was originally designed to remove grain from a ship's hold at an optimal rate of 33,000 bu./hr. on the dip, thus rating as perhaps the fastest in Buffalo at the time of their construction. The subcontractor responsible for the marine tower machinery was the Webster Manufacturing Company of Chicago.

Each tower stands 160' high and consists of a structural steel framework originally sheathed in corrugated iron. The floor slabs are concrete. Each tower accommodates a retractable marine leg with head and boot pulleys spaced 98' apart on centers. The crosshead of each marine leg, which carries the head pulley and its driving motor, travels up and down a maximum of 58' as the level of grain within the hold changes. Within each leg, a belt carrying a staggered double row of Buffalo buckets, each 15" x 8", 8" deep and spaced 12" apart, originally scooped up grain from the vicinity of the boot pulley. When grain no longer flowed to the boot pulley by gravity, powered ship shovels moved the cargo within reach of the leg.

Each tower also contained apparatus for weighing grain continuously and raising it to the top of the structure and thence to the internal distribution system over the elevator's storage bins. This weighing and elevating equipment included steel garners above and below a 500-bushel hopper scale, as well as a marine lofter leg with four staggered rows of flat back Buffalo buckets, originally each 14" x 8", 8" deep and spaced 13" apart. The marine lofters discharged grain into fixed V-spouts on the roof of the cupola. Both marine towers remain in active use for unloading deep-draft vessels.

The marine towers and legs were originally driven by a series of electric motors with assorted power trains. A 150 hp motor drove the buckets of each leg through a double reduction chain drive. The ship shovel set in each tower was provided with a 100 hp motor and a herringbone helical cut single reduction gear unit. The hoist raising the counterweighted marine leg operated via a 20 hp motor and silent chain drive. This hoist countershaft motor also drove the pusher boom that moved the marine leg laterally within the ship's hold by using a pair of leather belts for forward and reverse motion. A 200 hp motor connected to the head pulley by a herringbone reduction gear unit powered each marine tower lofter leg. A reversible 30 hp motor with combination gear and silent chain power train operated the winch and cable-haulage arrangement which moved each marine tower along the dock. While some of these motors may have been upgraded by rewinding, the transitional drive trains in the marine towers appear to have remained basically unmodified.[27]

The first cargo of grain was unloaded through the Standard marine towers on October 14, 1928, when the steamer J. B. John delivered 75,000 bushels of wheat and 40,000 bushels of corn.[28] The average unloading capacity of the twin marine towers, estimated at 40,000 bu./hr. as of 1930, reflected periods of operation when the ship shovels had to assist the leg in removing grain. This figure remained constant until the early 1970s when the nominal unloading rate of each leg was reduced to the present level of 15,000 bu./hr.

Receiving by Rail

As of 1928, rail cars were unloaded at the track shed on the north side of the elevator adjacent to the east workhouse. Manually-operated power shovels delivered grain to a car pit, the common mode of unloading prior to the advent of car dumpers. A Weller car puller driven by a clutch-operated 60 hp at 800 rpm motor spotted each car over a receiving hopper beneath the twin tracks. An electrical interlocking mechanism prevented the track grates from being opened simultaneously. A pair of Clark automatic power shovels, also supplied by Weller Manufacturing Company of Chicago, emptied grain out of boxcars and into the track hoppers. A 15 hp motor with flexible coupling drove the car shovels, while a 36" conveyor belt driven by a 7 1/2 hp motor connected the receiving hopper with a short jack leg driven by a 15 hp motor. The jack leg lifted grain discharged into its boot from the rail receiving belt; from this jack leg grain was spouted to the boot of either lofter leg in the east workhouse. By 1930 this equipment was capable of emptying approximately four cars per hour and transferring 6,000 bu./hr. to the elevator. The car pits are no longer in service; the receiving hoppers have been filled with concrete.

In 1955 Standard Milling augmented its rail receiving capacity at the elevator by adding a second-hand car dumper.[29] Such technology for removing grain from boxcars had been available since the end of the World War I.[30] Standard's belated decision to install the car dumper represented a response to the impending completion of the St. Lawrence Seaway. During the construction period, when grain shippers projected a decline in lake transshipments at Buffalo, some elevator operators anticipated a counterbalancing growth in rail traffic. Despite its relative antiquity, the car dumper was still capable of unloading a 2,000-bushel freight car in about six minutes. Overall rail receiving rates at the Standard Elevator, which had fallen to two cars per hour at the car pit, were projected to at least triple to 50-60 per day with the car dumper in service. A steel-frame structure, 10'-4" x 26'-28" and 79'-4" deep, housed the new equipment at the north side of the elevator. The dumper installation required new railroad tracks and a diesel engine for spotting the cars. As hopper cars replaced boxcars for grain shipments, emptying the cars by tilting them became unnecessary. Although the tilting mechanism is no longer active, both rail cars and trucks continue to use the two receiving hoppers at the car dumper.

Instore Distribution: Horizontal Transfer and Vertical Handling

Grain unloaded through the Standard's marine towers reaches the storage bins directly through rooftop V-spouts and cupola turnheads or via the receiving belt conveyors with portable belt loaders. Approximately half the V-spouts now in service are replacements for the originals. As of 1928, the two 48" reversible receiving belts, located in the cupola over the bin floor, were driven by 75 hp at 485 rpm electric motors through herringbone reduction gears; belt operating speed was 800' per minute. A Weller self-propelled 8" style AA tripper diverted grain from each belt to the desired storage area. Grain discharged from storage bins reached the east and west workhouses via three 42" shipping belts running longitudinally through the basement beneath the rows of silos. The motors driving the basement conveyors were originally rated at 60 hp at 600 rpm.

In the 1942 annex, there are two 42" receiving belts on the bin floor and two 42" shipping belts in the basement. Neither pair of belts is continuous with the horizontal transfer systems in the original Hecker Elevator. Bin floor belts in the annex are fed from the distributing belts in the older section, but the annex basement belts terminate at the east workhouse lofter leg boots. The raised interstitial bins in the annex originally could be spouted in either direction using the two shipping belts.[31]

Rail shipments unloaded through the car pits were elevated in the east workhouse on two lofter legs with individual capacities of 20,000 bu./hr. Each leg was driven at the head pulley by a 150 hp at 750 rpm electric motor with an oil-lubricated reduction gear unit. The legs carried double rows of 18" x 8", 8" deep buckets. Upon reaching the workhouse cupola, grain could be sent through either of two concrete, steel-bottom 2,500-bushel garners to be weighed in either of two 2000-bushel Fairbanks hopper scales. Grain was then distributed to storage bins through the spouting or horizontal conveying systems. The west workhouse contained a comparable lofter leg, garner, and scale for handling shipments out of the elevator via the dock spout, as well as distribution spouts to bins, belts and conditioning machinery.

Grain Conditioning

Original equipment for reconditioning grain was situated at the west end of the elevator.[32] From the west workhouse, a spout distributed grain to a receiving bin atop the adjoining drier house; from that point the flow could be routed back to the cleaners and clippers in the lower part of the west workhouse. Three 10,000-bu./hr. double and aspirating Eureka separators were driven by 25 hp motors through double roller chains, and two 1,500-bu./hr. Eureka oat clippers were powered by 75 hp motors. The separators were Model No. 392, featuring two screens in each shoe and brush sieve cleaners under the seed screens in both shoes.[33] The clipping and cleaning machines, manufactured by the S. Howes Co. of Silver Creek, New York, are no longer extant.

Grain that required washing or drying reached the distribution floor of the drier house via the transfer spout from the west workhouse and turnspouts to the conditioning bins. Drier house materials handling apparatus included three lofter legs, one supplying the washers and the others serving the driers, and two 9" screw conveyors for horizontal transfer. Other equipment consisted of four 400-bushel wheat washers for smut removal, two 750-bushel direct heat driers, and a set of coolers.

The Richmond Manufacturing Company of Lockport, New York, made the washers, and the O. W. Randolph Company of Toledo furnished the driers. Once washed, grain was transferred laterally by a screw conveyor, reelevated by one of the lofters, and directed via turnspout to the receiving bins over the driers. Grain that had gone through the full cycle of washing, drying and cooling passed through a screw conveyor, drier house lofter leg, turnspout and drier house receiving bin, before being spouted to the boot of the west workhouse lofter for re-elevation. Cleaners were normally operated for twelve hours, but the driers, being of smaller capacity, required 24-hour operation. Grain delivered by rail car usually required more cleaning than shipments via lake vessels, which were customarily treated at the head of the lakes.

Dust Collection

The original dust prevention system for minimizing potential explosions was particularly elaborate. Grain dust was collected and removed through a combination of pneumatic suction and sweeper units located in several areas of the elevator, including storage bins, receiving and shipping belts, elevator legs, the head and scale floors, and the cleaner floor. The principal danger points where dust was generated included lofter leg boot tanks, the car receiving pit, belt loaders, marine leg turnhead spouts, and tripper spouts. Motor-driven exhaust fans included direct connected 60 hp units on the basement and bin floors.

Dust collected at various points went to a central bin adjacent the track shed. Dust stored there was compacted by a Monitor Dust Packer and then placed in sacks for shipment.

Modifications to the original dust collection system included a sheet metal enclosure adjacent to the drier house used for trapping dust previously vented into the atmosphere from the heating units. This dust was then collected manually with wheelbarrows. Nine new motors plus controls were installed on elements of the dust collecting system in 1976.[34]

Shipping by Water

Shipments out to canal barges or vessels plying the Montreal route were handled through the west workhouse. Grain from storage was taken via the basement conveyors to a 20,000-bu./hr. lofter leg feeding a 2,500-bushel garner and a 2,000-bushel scale with subsequent delivery to the shipping bin located at the southwest corner of the elevator. Grain was loaded through a telescopic sheet-steel dock spout, 15" in diameter and 42' long when fully extended. As of 1930 normal vessel-loading capacity was rated at 30,000-bushels per hour. This quantity was subsequently reduced to 16-17,000-bu./hr. by 1942 and 20,000-bu./hr. in 1971. By the late 1980s, the practice of loading grain aboard vessels had been discontinued, and trucks had also ceased their occasional use of the vessel-loading spout.

Shipping by Rail

The loading of rail cars was handled through the east workhouse. The sequence of operations commenced with the basement shipping belts that supplied the house lofter legs and thence the workhouse garners and scales. Grain was weighed out in carload drafts to be directed via distribution floor turnspouts to the carloading spouts. Each track in the car shed was originally serviced by a steel carloading spout with a bifurcated attachment designed to fill both ends of a boxcar simultaneously. These attachments are no longer extant since hopper cars have replaced box cars. Initial carloading capacity was 40,000-bushels per hour, equivalent to filling approximately 200 cars during a 10-hour period. After World War II, the carloading rate was downgraded to 150 cars over ten hours. Currently, the capacity of each car spout is rated at 8000-bushels per hour.

Shipping by Truck

During recent decades, truck shipments have played an increasingly significant role at the Standard Elevator, and original materials flows have been modified as a result. A truck weigh station was added to the northwest side of the elevator in

1959.[35] By the early 1970s, five spouts had been provided at the northwest end of the elevator for loading trucks at an overall rate of 34,000-bushels per hour. Equipment in the west workhouse, once dedicated primarily to waterborne commerce, now handles these outgoing shipments to vehicles. Grain deliveries via truck make use of the rail unloading facilities and are capable of discharging 15,000-bushels per hour.

ENDNOTES

1. The following paragraphs are based on information from several sources including building permits, plans books and original drawings housed in Buffalo City Hall. Original plans were inspected courtesy of Henry Baxter. A detailed description of the structure appears in Grain Dealers Journal, Special Plans Book 5 (1942), 165 and Northwestern Miller (11 July 1928).

2. Buffalo Live Wire, XI, no. 8 (August, 1920): 26.

3. Buffalo City Directory, 1930, 1940; Moody's Industrials, 1940.

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5. Buffalo Evening News, 16 April 1926, 17; Buffalo Live Wire, xvii, no. 9 (September, 1926), 15; Buffalo Courier-Express, 21 December 1927, C4, 13.

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23. Lake Carriers, p. 111; Buffalo Evening News, 15 February 1939; Buffalo Courier-Express, 22 April 1935, p. 1; Buffalo Evening News, 22 April 1935, Sec. 5, p. 1; Buffalo Courier-Express, 9 October 1938, Sec. 5, p. 1; Buffalo Evening News, 8 October 1938, p. 10.

24. Moody's Industrials, 1940; Buffalo Evening News, 15 February 1939.

25. Steen, Flour Milling, 321-22; Moody's Industrials, 1940.

26. Steen, Flour Milling, 322; Moody's Industrials, 1946.

27. On changes in grain elevator power transmission systems see L. Coke Hill, "Recent Advancement in the Construction and Operation of Grain Elevators," Engineering Journal 8 (April, 1925): 151-2.

28. Buffalo Courier-Express, 15 October 1928, p. 6.

29. Building Permit #53780 (1 June 1955); Buffalo Courier-Express, 19 June 1955, p. 4.

30. On car dumpers see "New Grain Unloader Saves Time at Elevators," Railway Age 69 (16 July 1920): 93-4; R. T. Kintzing, "Electrically Operated Grain Car Unloaders," Electric Journal 18 (July, 1921): 301-04; F. Newell, "Automatic Box Car Unloaders for Grain," Engineering Journal 5 (September, 1922): 451-6; "Dumping Plant for Grain Cars," Engineering 121 (4 June 1926): 650-52 and

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APPENDIX

Mainhouse

Cost:	$450,000
Foundation:	Caissons 4'-6" diameter, support network of foundation beams 3' deep, and between 5' & 3'-6" wide; reinforced with round rods Basement beams support 10" floor slab reinforced with 1/2" round rods in diagonal grid
Basement:	Enclosed within bin walls; bin walls rise from floor slab and are pierced by conveyor and personnel passages between bins; radial basement pillars (2' x 1'-4" x 8'-6") abutting against bin walls support a concrete ring girder with an outer 12-sided face; the girder is 2'-6" at its widest point and 4'-6" deep; the network of girder reinforcing is not curved to the radius of the bin, but follows the line of the inner face; 1/3 above grade, ventilator openings only
Hopper:	Conical steel to full width of bin supported on concrete ring girder
Bins:	Capacity 3,000,000 bushels Main bins 20 x 3 in parallel rows, cylindrical 25' in diameter on 26' centers; to height of 124' above floor slab and 112' above the top of the ring girder; three at SW end subdivided horizontally, one for shipping, the remainder accommodate cleaning machinery and cleaner bins Interspace bins 19 x 2 No outerspace bins Square bins, 6 in drier and washer houses Tangential contacts to all bins; contact wall 9'-4" long Wall thickness 8", at contacts 12" Vertical reinforcing, 11 round vertical rods and 11 1" round jacking rods; verticals placed centrally in wall Horizontal reinforcing wired to outside of verticals, graduated round rods at varying course intervals; 3 rods to each course, 30" overlap; pattern of reinforcing differs in cylindrical cleaner bins

Bin Floor: Monolithic concrete on I-beams; floor extends to form overhanging eaves with concrete covered ends of the I-beams acting as corbels

Gallery: Monolithic concrete with elongated windows between piers

Workhouses: Monolithic concrete, vertical pier & panel Integral concrete garner hoppers; vertical reinforcing of staggered inner and outer 1/2" rod; horizontal reinforcing with graduated rods and varying course intervals; dimensions and coursing of inner & outer rods varies independently

Marine Towers: Movable, structural steel clad in corrugated iron

REFERENCES: Original plans inspected courtesy of Henry Baxter. Dates from City Building Permits, costs from City Plans Book 1928. Detailed descriptions of the structure appears in Grain Dealers Journal, Special Plans Book, 5 (1942): 165, and Northwestern Miller (7 November 1928).

Annex

Cost: $275,000

Foundation: Rectangular sub-piers, stepped outward to form a broader head; piers arranged so that all pillars, tangential contacts, link & strut walls land above the broadened pillar head; a 9" floor slab lies over the piers

Basement: Enclosed within bin walls, bins rising from floor slab; free-standing radial basement pillars support concrete ring girder; 8 pillars in the larger 38' bins, 6 in the 30' bins; pillars 1'-10" x 1'-6" x 14'-6"; ring girder has curved inner face, 4'-6" deep x 3'-6" wide, tied into the bin wall; basement height 14'-4" to ring girder, 1/3 above grade; lit by 2 small windows per bin

Hoppers: Conical concrete hoppers 6" thick to full width of bin, supported on ring girder; hopper angle 40°; interspace & outerspace hoppers of slab concrete; those in the interspace slope outward in both directions from a central beam supported by a pillar in the interspace basement; those in the outer space slope to a single draw-off and are supported by beams tied to the bin walls and a downward extension of the strut wall

Bins: Capacity 2,000,000 bushels
Main bins, 8 x 2 in parallel rows, all bins 38'-1-1/2" in diameter, except at the east end where the building tapers; the final bin of the southern row is of 36' in diameter; the last two bins of the northern row are 30' in diameter; bin height 124'-6" from foundation slab, 105'-6" from top of ring girder
7 interspace bins
14 outerspace bins, convex 1/4 circle outer wall; inner wall is not at closest point of contact between bins, but inside this point
Tangential contacts transversely, non-tangential contacts longitudinally, by link and strut walls; tangential contacts are 15' wide; the link walls are not positioned at the closest point of contact between bins, but inside this line; a supplementary strut wall divided vertically into three 15" sections spans the outer bin outside the line of closest contact; link and strut walls are straight; link walls 7'-6" long
Wall thickness 8", at tangential contacts 8", strut walls 8"
Vertical reinforcement 1/2", round rod for both ordinary verticals and jacking rods; 18 jacking rods per 38' bin, 3 per 1/4 bin wall Ordinary verticals in exterior walls only on 18" centers; verticals 13'-10" long with 20" overlap and centered 3" inside the outer surface of the wall
Horizontal reinforcing, round rod in graduated sizes at variable course intervals; outerspace bin walls reinforced with smaller bars for any given course; 1/4 wall bars hooked over the main bin bands and tied to the main bins by triple contact anchors bent about main bin verticals The contact anchors are of 1/2" bar, two tying back through the fillet and one forward; link & strut walls have double contact bars at every course

Bin Slab & Gallery: Monolithic concrete on I-beams
Monolithic concrete

REFERENCES: Original drawings are housed in Buffalo City Hall. City Building Permits provide the dates and City Plans Book for 1936 costs.